AN ANALYSIS OF DATA RETURNED BY OUTFITTED HUNTERS FROM THE MACKENZIE MOUNTAINS, NWT 1979-1990

Northwest Territories Renewable Resources

103-05924/

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GOVERNMENT OF THE NORTHWEST TERRITORIES

NORMAN WELLS, NWT

1994

Northwest Territories Renewable Resources

File Report No. 110

ABSTRACT

Data on big game trophies harvested in the Mackenzie Mountains were recorded from 1979 to 1990 by each of the eight outfitters operating there, Wildlife Officers, and by personnel at the various exporting stations in the NWT. Data recorded were horn/antler measurements for Dall's sheep, woodland caribou, moose and mountain goat, raw pelt length for wolves, location of kill, days hunted for each species, and horn annulations of sheep.

Numbers of hunters declined during the early to mid-1980s then increased to levels at, or slightly above, those in the early 1980s. There was a corresponding decline then increase in the numbers of big game harvested. A mean of 221 outfitted hunters hunted in the Mackenzie Mountains each year with a mean of 31 in each outfitting zone. Outfitted hunters devoted more time in pursuit of Dall's sheep than they did for either woodland caribou or moose. Trophy size of Dall's sheep and woodland caribou remained constant during the twelve years, although the mean age of sheep harvested increased by approximately one year between 1979 and 1987. Moose trophy size increased slightly during the late 1980s.

The northern outfitting zones showed a trend toward larger trophies for Dall's sheep, but the difference between them and the more southerly outfitting zones was only 2-3 cm of horn length. These zones also showed a trend toward larger woodland caribou.

Mountain goats were harvested in only two outfitting zones in the south-central part of the Mackenzie Mountains. Wolves were harvested in all zones, but two central zones accounted for the majority. Wolverines were harvested in small numbers in all zones.

The impacts of hunting on populations of big game in the Mackenzie Mountains is difficult to assess at this time because of the paucity of demographic data for each species.

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INTRODUCTION

Between 1938 and 1953, the Mackenzie Mountains were designated as a Game Preserve and hunting of big game was open only to Dene living in the Mackenzie Valley. Some of these people had ties with the Mackenzie Mountains as a traditional hunting and trapping area. In 1953, Game Preserve status was removed and the area was also opened to resident hunting; however, very little hunting by residents occurred. In 1964, the Northwest Territories Government, in order to promote tourism and local economic benefits, formally invited interested outfitters already operating in western Canada and the Fort Smith area to submit applications to outfit non-resident hunters in the Mackenzie Mountains (Murphy 1976). Initially, six outfitters were granted permission and the first hunting by non-residents occurred in 1965. Interest by the trophy hunting fraternity in this new and virtually unhunted mountain wilderness was immediate, and one outfitter (P. Linton, pers. comm.) had fifty hunters that first year. Prior to 1971, by which time one partnership had split and two new outfitters were operating in the northern-most part of the mountains, no official outfitting area boundaries existed. Separation of outfitting areas was primarily by 'gentleman's agreement'. In 1971, upon request by the outfitters themselves (P. Linton, pers. comm.), legalized boundaries for eight outfitting zones were established and these have remained virtually unchanged to the present day (Fig.1) (Murphy 1976).

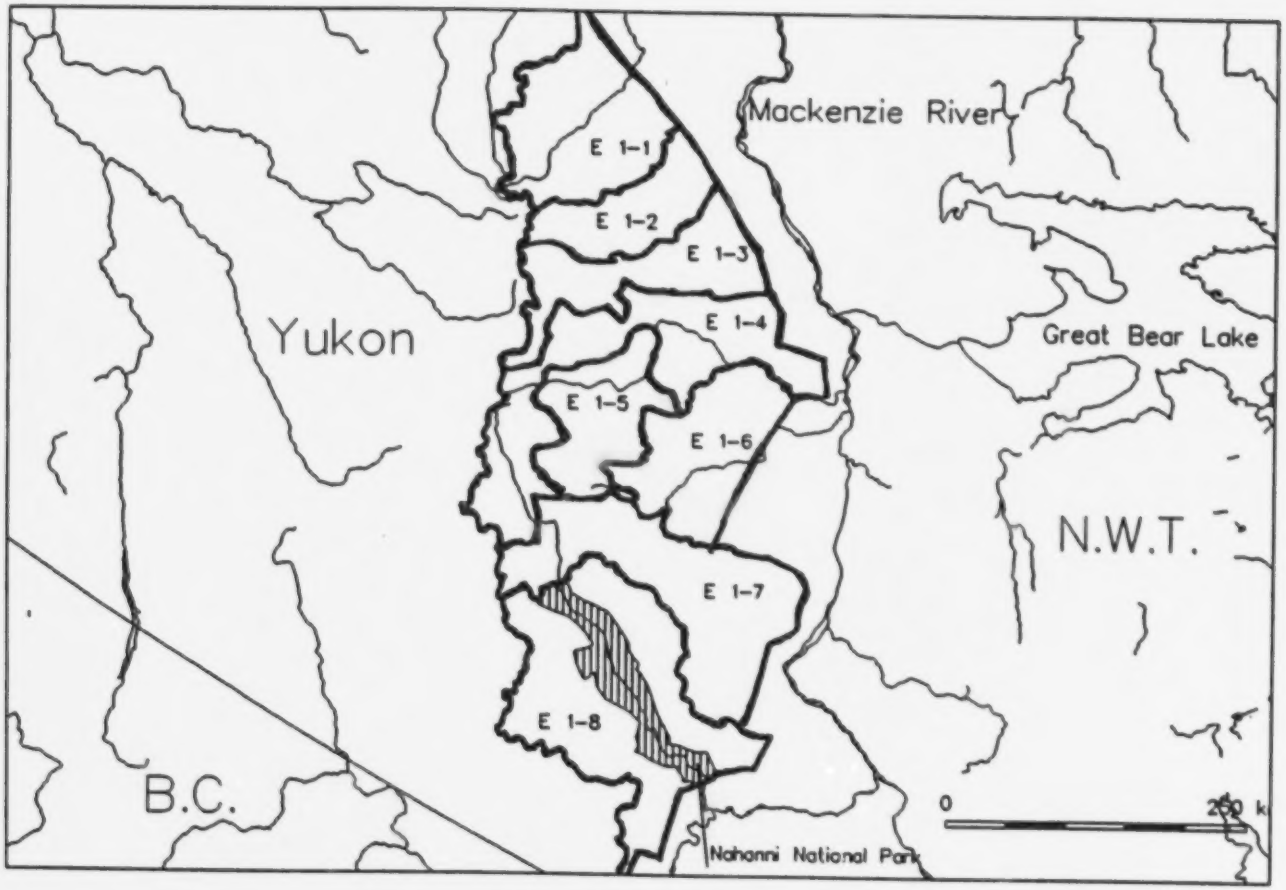


Figure 1. Outfitter zones in the Mackenzie Mountains, Northwest Territories.

Regulation of big game hunting in the Mackenzie Mountains is minimal. The outfitted (i.e., non-resident) hunting season for Dall's sheep (*Ovis dalli dalli*), mountain goat (*Oreamnos americanus*)(15 July - 31 Oct.), woodland caribou (*Rangifer tarandus tarandus*), timber wolf (*Canis lupus*), wolverine (*Gulo gulo*)(25 July-31 Oct.), and moose (*Alces alces*) (1 Sept.-31 Oct.) coincides with the only practical period the land can be travelled by horse or on foot. There are no restrictions as to the number of the above species that each outfitter can take in his zone. In the case of Dall's sheep, both resident and non-resident hunters are restricted to males having horns of three-quarter curl or larger. Studies of grizzly bears (*Ursus arctos*) in the Mackenzie Mountains (Miller et al. 1981) and other areas, indicated that the average annual kill of 40 bears in the Mackenzie Mountains prior to 1982 was a serious over-harvest. In 1982, a total ban was enacted on the hunting of grizzly bears by non-residents. Residents of the NWT were allowed one per lifetime. Hunting of big game in the Mackenzie Mountains by resident hunters remains low (approx. 10% of all hunters in the mountains each year). Native hunters, primarily from Fort Norman, harvest 50-100 woodland caribou and a small number of Dall's sheep each year in the Mackenzie Mountains.

Apart from some cursory inventory work (summarized in Collin 1983), biological research in the Mackenzie Mountains has been scant. Simmons (1982) and Simmons et al. (1984) studied movements and demography of Dall's sheep at sites in the central Mackenzie Mountains and Stelfox (1975) assessed sheep range at several

locations. Simmons (1970)(cited in Collin 1983) conducted aerial surveys of woodland caribou and his co-workers (Armbruster 1972, Nielsen 1976 cited in Collin 1983) conducted brief investigations of movement and behaviour. Grizzly bears were studied in the mid-1970s in the central Mackenzie Mountains by Miller et al. (1981). Recently, the only biological study has involved regular but limited monitoring of Dall's sheep productivity and numbers by the NWT Department of Renewable Resources (Shank et al. in prep.) and aerial surveys of portions of the mountains (Ferguson et al. 1985, Case 1989, Latour 1992). In addition to this monitoring, the Department also maintains a data base of trophy measurements from each of the eight outfitters and, in fact, has been doing so ever since the inception of outfitted hunting in the Mackenzie Mountains.

This report is a summary of the last twelve years of data submitted to the Department of Renewable Resources by each of the eight outfitters in the Mackenzie Mountains as required by the NWT Wildlife Act (R.S.N.W.T. 1988 c.W-4). The major purpose is to examine trends in the quantity and trophy size of big game harvested over the last twelve years from the eight outfitting zones as well as trends in number of hunters and hunting effort.

METHODS

Data Origin

This analysis used data on big game harvested by outfitted hunters and returned to the Department of Renewable Resources from 1979-1990 by each of the eight outfitters operating in the Mackenzie Mountains. The data from 1979-1985 were recorded by the outfitters in specially designed booklets supplied to them by the Department. These booklets were handed in to the Department at the end of the hunting season or by individual hunters at the time they exported their trophies through either Norman Wells, Fort Simpson, Tungsten, or Mile 222 on the Canol Road. From 1986-1990 Dall's sheep trophies were measured by either Wildlife Officers at Norman Wells and Fort Simpson or by personnel hired to facilitate exporting at the other two locations. Data from woodland caribou and moose have continued to be recorded by the outfitters alone. Figure 2 is a sample of the data sheet supplied to the outfitters at the beginning of each hunting season. Until 1986, all these data were simply kept on file at the Regional Office in Inuvik. After 1986, the data were entered directly into computer files as were the data from the preceeding six years. In 1988, all data files were transferred to the Sahtu District Office in Norman Wells and are maintained and updated by Wildlife Management Section personnel there.

N.W.T. DEPARTMENT OF RENEWABLE RESOURCES

MACKENZIE MOUNTAINS HUNTER QUESTIONNAIRE

Name_____ Outfitting area hunted in_____

_____

Dall's sheep

Date of kill_____ (D M Y) Location of kill_____ Lat. Long.

Horn length (outside curve): right_____cm. left_____cm.

Was 'lumpy jaw' evident when skinned? Yes____ No____

Estimated number of sheep seen: rams_____ewes_____ lambs_____

Number of days hunting Dall's sheep_____

_____

Woodland caribou

Date of kill_____ (D M Y) Location of kill_____ Lat. Long.

Antler length: right_____cm. left_____cm. spread_____cm.

Estimated number of caribou seen: bulls_____ cows_____ calves_____

Number of days hunting caribou_____

_____

Moose

Date of kill_____ (D M Y) Location of kill_____ Lat. Long.

Antler spread at widest point_____cm.

Estimated number of moose seen: bulls_____ cows_____ calves_____

Number of days hunting moose_____

_____

Other species killed (please check-off where appropriate)

Black bear_____ Mountain goat_____ Wolf_____ Wolverine_____

_____

Comments_____

_____

Please return to: District Biologist, Norman Wells, N.W.T.

Figure 2. Hunter questionnaire submitted by all outfitters.

Considerable streamlining of file structure since 1989, plus implementation of the computerized Game Licensing System, has facilitated the retrieval of information on big game licensing in the NWT. Information on the number of hunters purchasing tags for particular species is now more readily obtained. Despite these improvements, this Territorial wide system is not detailed enough to address specific questions pertaining to the Mackenzie Mountains. For example, this system cannot provide information on numbers of hunters outfitted in each zone per year nor can it be used to determine hunter success. For the present analysis, because we knew that virtually all outfitted hunters harvested at least one big game animal, and since each animal must be reported, it was assumed that the number of reporting hunters (i.e., successful hunters) equalled the total number of hunters in a given year. In the future, information on the number of hunters outfitted yearly within each zone in the Mackenzie Mountains should be tabulated by the Area Office in Norman Wells when tag packages are assembled for each outfitter. This information, coupled with the reported harvest for each species, would also enable determination of hunter success.

Dall's Sheep

The length of Dall's sheep left and right horns (outer circumference) was measured using a cloth tape. The tape was placed at the front and base of the horn then run along the top

edge of the horn back to the tip. Horn annuli were counted beginning at the lamb tip and working along to the base of the horn. From 1981-1988, incisor teeth from the lower mandibles that each outfitter submitted were thin sectioned in a freeze cryostat and stained using the technique first outlined by Thomas (1977). The ages obtained were then regressed against the ages obtained by counting horn annuli. In this way, the practicality of continuing with the mandible collecting was determined. Hunters also recorded the number of days they hunted sheep, the date and location of their kill, and the number of sheep observed during hunting.

Woodland Caribou

The length of woodland caribou left and right antler (main beam) was measured using a cloth tape. The tape was placed at the inside base of the antler and extended along the inside edge of the antler all the way to the tip. The maximum spread of the antlers (between any two tine tips) was measured. Hunters also recorded the number of days they hunted caribou, the date and location of their kill, and the number of caribou observed during hunting.

Moose

The maximum spread of the antlers for each moose (between any two tine tips) was measured. Hunters also recorded the number of

days they hunted moose, the date and location of their kill, and the number of moose observed during hunting.

Other Species

Hunters recorded whether they had killed a wolf, wolverine, mountain goat, or black bear. For goats, the length of the longest horn was measured. For wolves the total length of the raw hide was measured. No measurements were obtained from the other species.

RESULTS

Number of Hunters

From 1986-1990 the total number of hunters outfitted in the Mackenzie Mountains increased from the lows of the mid-1980s to equal the numbers during the early 1980s (Fig. 3). There was a statistically significant difference among the years (X^2=137.7, P<.05). The mean number of non-resident hunters each year from 1979 to 1990 was 221. The proportion of non-residents that were Canadians has remained relatively stable over the twelve years with a mean of 22% (s.e $\pm$1.5) each year.

Comparison of outfitting zones indicated significant differences between areas in the number of hunters outfitted each year (Fig. 4), both when all eight zones were considered (ANOVA, F=11.0, P<.05) and when the two zones with widely varying numbers of hunters each year were omitted from the analysis (E/1-7,-8) (ANOVA, F=13.4, P<.05). All zones showed significant fluctuation (chi-square tests, P<.05) over the twelve year period (Fig. 4). The mean number of hunters per zone each year was 31 (s.e. $\pm$3).

The outfitting zones in the Mackenzie Mountains vary considerably in size (Fig. 1). Simple regression analysis did not indicate, however, a significant relationship between the size of a zone and the average number of hunters in that zone each year (r^2=.21, P>.05). In other words, outfitters were not scaling the

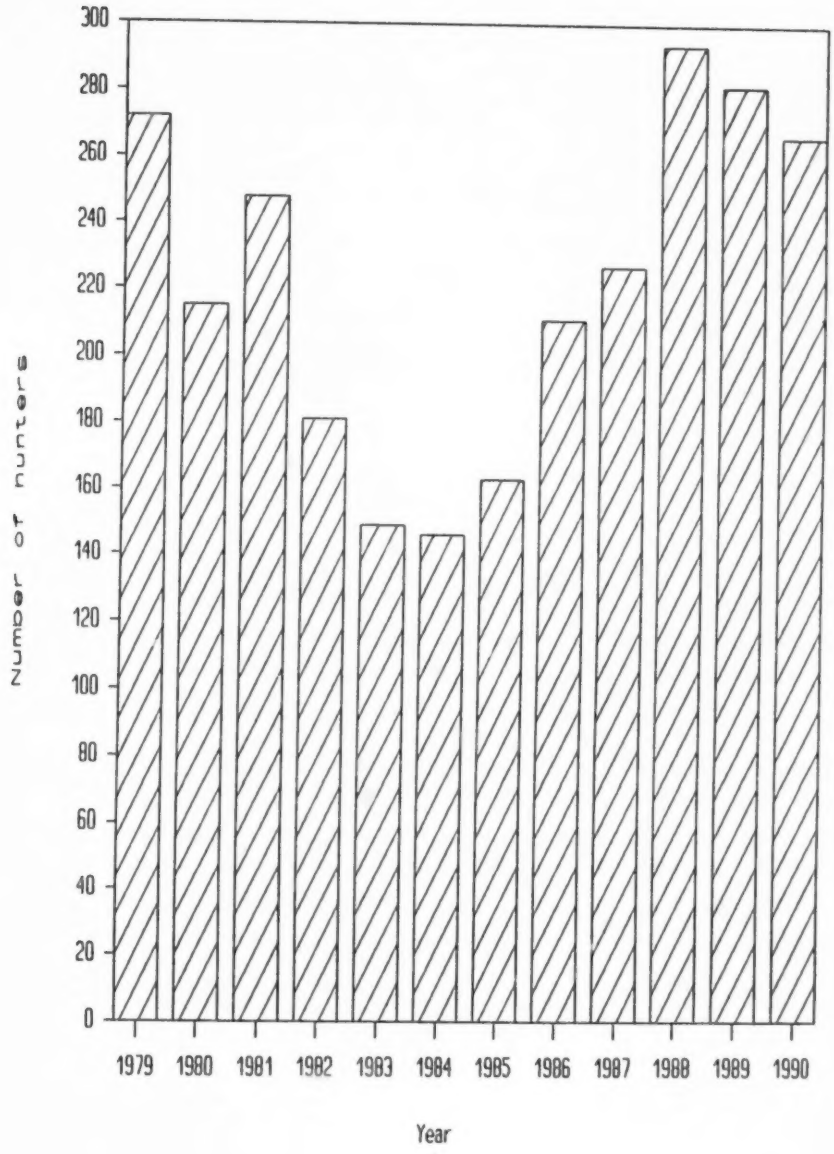
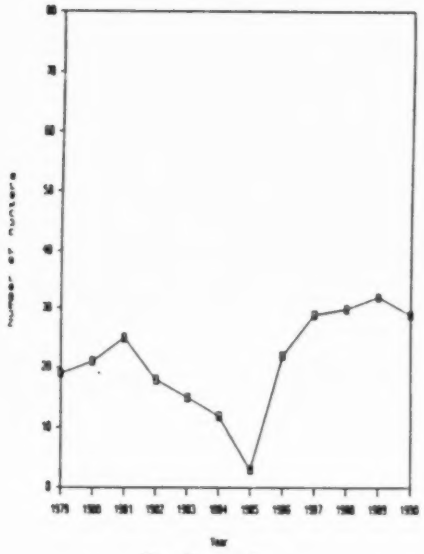
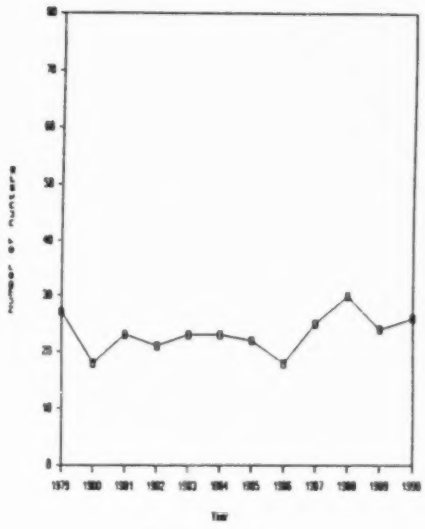


Figure 3. Total number of successful outfitted hunters in the Mackenzie Mountains, 1979-1990.



E / 1-1



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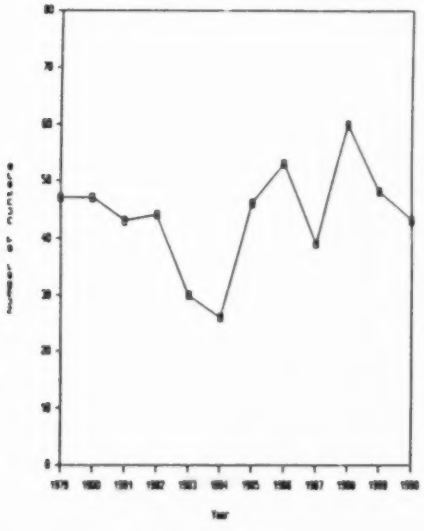
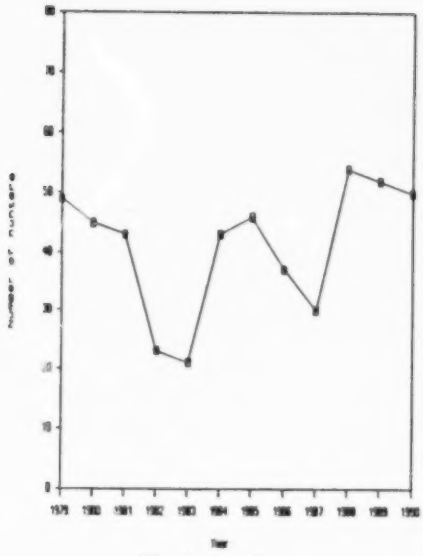


E / 1-3

Figure 4. Number of successful hunters each year by outfitting zone, 1979-1990.



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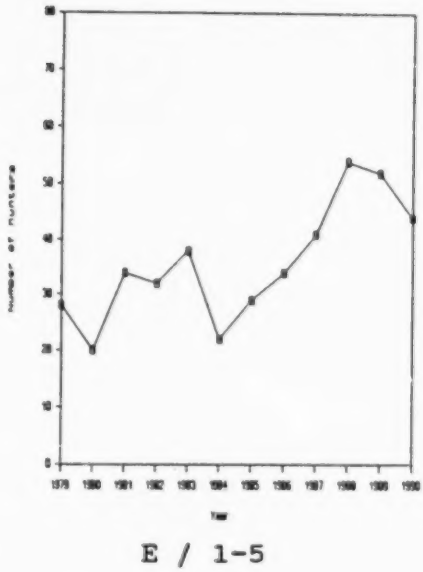

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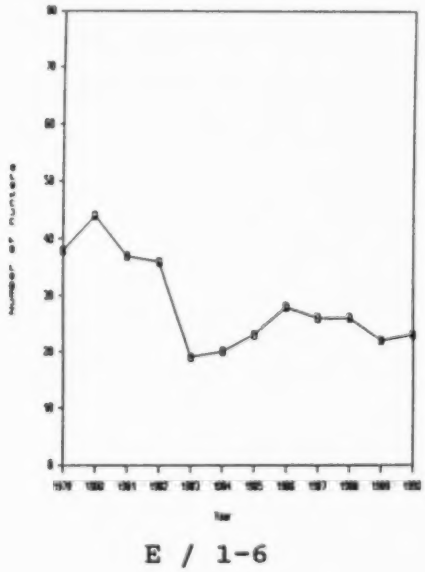
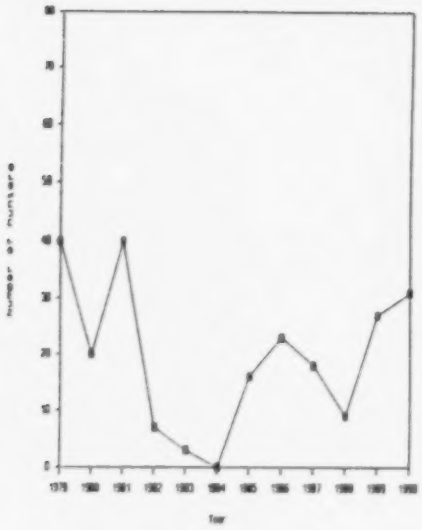
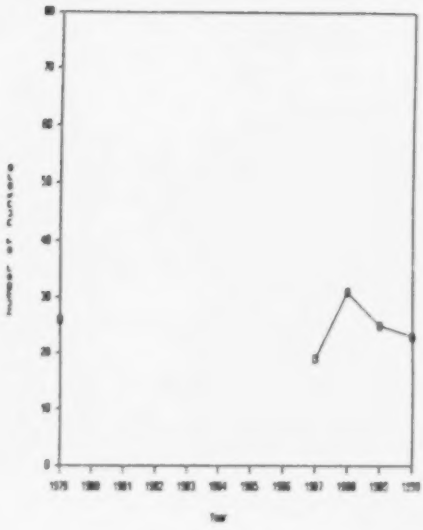


E / 1-6

Figure 4(cont). Number of successful hunters each year by outfitting zone, 1979-1990.



E / 1-7



E / 1-8

Figure 4(cont). Number of successful hunters each year by outfitting zone, 1979-1990.

number of hunters to the amount of terrain available to them for hunting.

Dall's Sheep

The total number of Dall's sheep rams harvested since 1985 by outfitted hunters each year steadily increased from the lows of the early-1980s (Fig. 5). The harvest during the late 1980s, however, was only marginally higher than that in the early 1980s. There was a significant difference among the twelve years (X^2=111.2, P<.05). A mean of 161 (s.e. ±12) Dall's sheep rams were harvested by outfitted hunters each year in the entire Mackenzie Mountains (total=1936 sheep). This fall and rise in the harvest of sheep corresponded closely with the fall and rise in the number of hunters during the mid- and late 1980s (r^2=.83, P<.01).

Comparison of left and right horn lengths (Table 1) indicated that there was no significant difference between them over the last twelve years (t-test, t=-0.43, P>.05). The mean left and right horn length for sheep taken in all eight outfitting zones over the last twelve years was 90.4 cm for both horns (total=1755 sheep). Therefore, only the right horn was used in subsequent analysis of trophy size.

There was a significant difference among years in the length of the right horn (ANOVA, F=4.4, P<.05), although pairwise comparisons of the twelve years (Duncan multiple range test)(Table 2) did not indicate any temporal trend. There was a significant

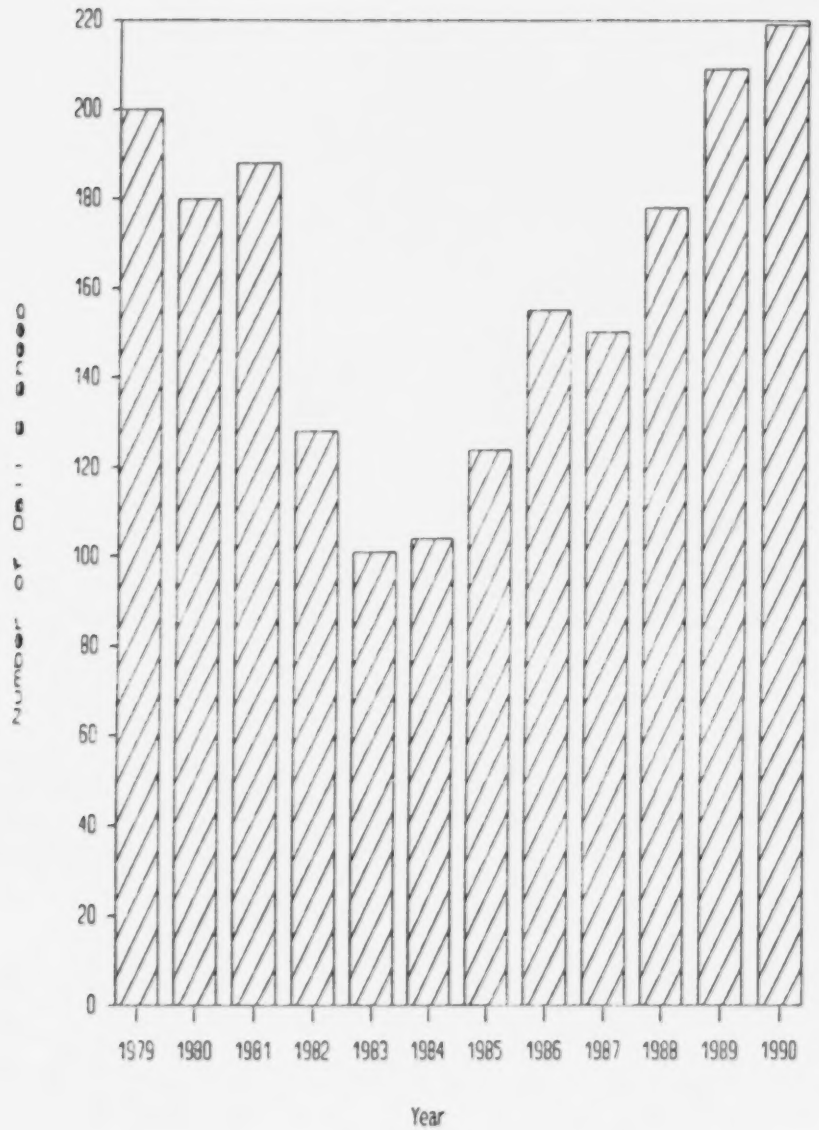


Figure 5. Total number of Dall's sheep harvested by outfitted hunters in the Mackenzie Mountains, 1979-1990.

Table 1. Mean outside circumference of right and left horn from Dall's sheep, 1979-90.

Year	N	Horn circumference(cm)	
		Left	Right
1979	159	90.1	90.7
1980	127	89.4	89.9
1981	157	92.5	93.7
1982	124	91.4	89.7
1983	94	90.7	90.9
1984	99	91.2	91.2
1985	112	89.9	89.7
1986	153	89.7	88.4
1987	148	88.9	89.4
1988	161	92.0	91.7
1989	203	90.4	90.4
1990	218	89.7	90.2

Table 2. Pairwise comparisons by year of right horn outer circumference from Dall's sheep (Duncan's multiple range test). (NS indicates a statistically non-significant difference between 2 years).

	79	80	81	82	83	84	85	86	87	88	89	90
79	--	NS	**	NS	**	**	NS	**	NS	**	NS	NS
80		--	**	NS	**	**	NS	**	NS	**	NS	NS
81			--	**	**	**	**	**	**	**	**	**
82				--	**	**	NS	**	NS	**	NS	NS
83					--	NS	**	**	**	NS	**	**
84						--	**	**	**	NS	**	**
85							--	**	NS	**	NS	NS
86								--	**	**	**	**
87									--	**	NS	NS
88										--	**	**
89											--	NS
90												--

difference among outfitting zones in the length of the right horn (ANOVA, $F=10.9$, $P<.05$). Pairwise comparisons (Duncan multiple range test) indicated a significant northward trend in length of the right horn (Table 3). Zones E/1-3,1-4,1-2, and 1-1 were all statistically grouped as having the longest right horn length.

The age of sheep as determined by horn annuli did not differ from age determined by incisor annuli between 1981 and 1988 when incisor teeth were collected (Pearson correlation coefficient, rho=.84). Therefore, all subsequent analyses of sheep ages used horn annuli counts only. The mean age of rams harvested in the Mackenzie Mountains during 1981-1990 was 9.1 years (s.e. $\pm$.04) (no data for 1979, 1980, or 1984) or, when taking into account that sheep were harvested mid-way between birth periods, 9.5 yrs. There was a significant difference among years (ANOVA, $F=31.7$, $P<.05$) in the ages of rams harvested. There was also a significant temporal trend in that the oldest rams were harvested in the last three years with an approximate 1 yr gain between 1979 and 1987 (Table 4). There was a significant difference among outfitting zones in the age of rams (ANOVA, $F=4.19$, $P<.05$). As with horn length, pairwise comparisons (Duncan multiple range test) indicated that the oldest rams came from the four northernmost outfitting zones (Table 5). Rams ranged in age from 5.5 yrs to 14.5 yrs (Fig. 6) and a mean of 17% each year were $\leq$6.5 yrs old (i.e., smaller than full-curl - see Discussion)(Fig. 7).

Table 3. Mean right horn outer circumference of Dall's sheep harvested from each outfitting zone, 1979-1990. (Circumferences arranged from highest to lowest).

Outfitting area	N	Mean circumference (cm)
E/1-3	295	92.2
E/1-4	328	91.7
E/1-2	194	90.9
E/1-1	195	90.9
E/1-8	103	90.7
E/1-5	174	90.2
E/1-6	274	89.2
E/1-7	164	86.6

Table 4. Comparison between years of ages of Dall's sheep, 1981-1990.

Year	N	Age (yrs)
1981	101	8.1
1982	98	8.7
1983	80	9.0
1984	198	8.4
1985	115	8.1
1986	132	8.8
1987	153	8.9
1988	166	9.8
1989	199	9.9
1990	200	9.8

Table 5. Mean age of Dall's sheep harvested in each outfitting zone, 1981-90. (Ages arranged highest to lowest).

Outfitting area	N	Age (yrs)
E/1-1	184	9.4
E/1-2	179	9.3
E/1-4	243	9.2
E/1-3	269	9.1
E/1-8	95	9.0
E/1-5	143	9.0
E/1-7	108	8.7
E/1-6	202	8.7

Table 6. Mean length of right antler main beam from woodland caribou, 1979-1990.

Year	N	Beam length (cm)
1979	81	112.7
1980	79	112.8
1981	84	116.8
1982	73	111.5
1983	66	114.3
1984	74	116.2
1985	95	114.2
1986	84	112.2
1987	73	116.0
1988	126	117.7
1989	110	114.1
1990	92	113.7

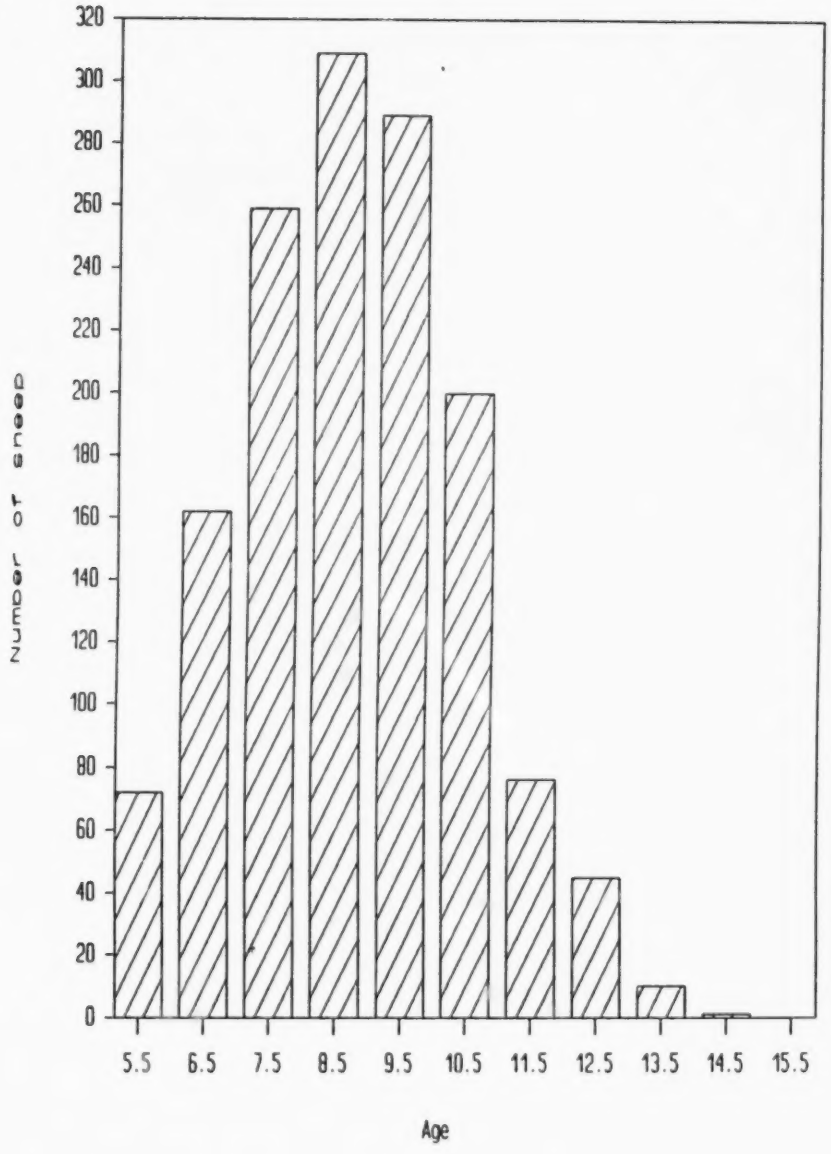


Figure 6. Age distribution of Dall's sheep harvested by outfitted hunters in the Mackenzie Mountains, 1979-1990.

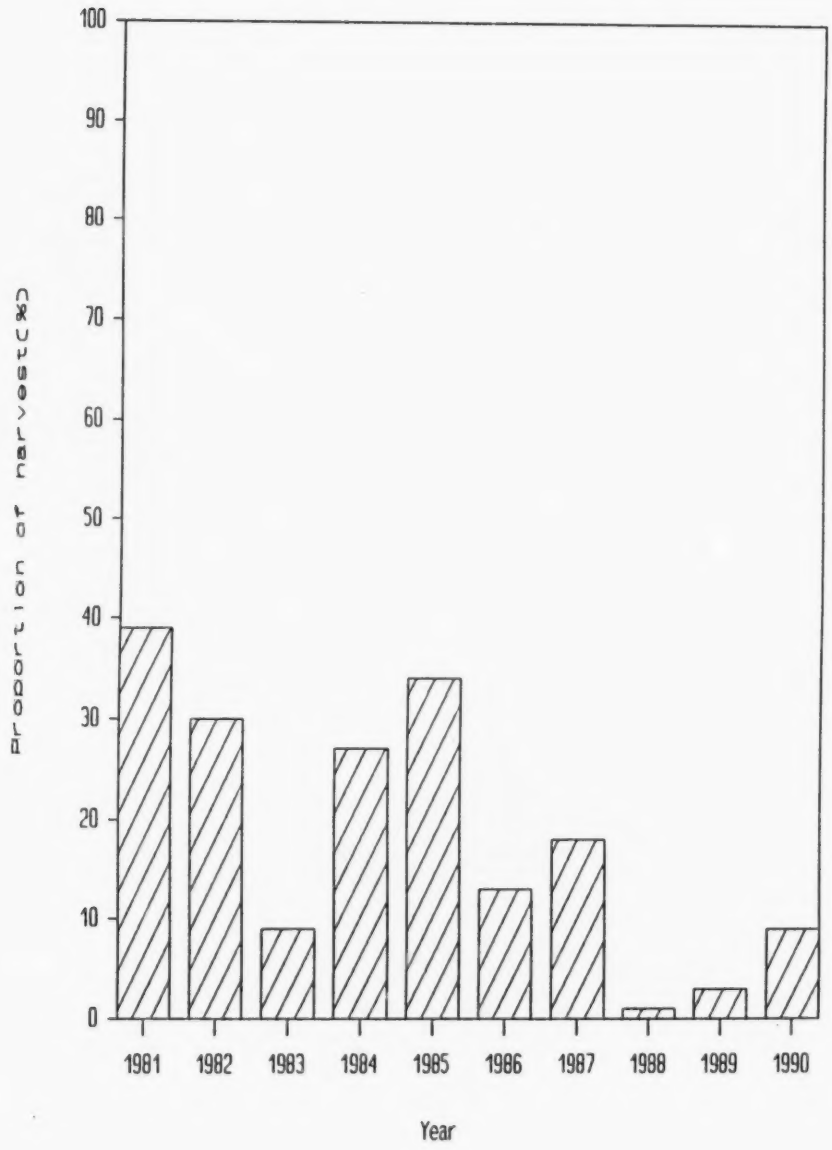


Figure 7. Proportion (%) of Dall's sheep rams <=6.5 years harvested by outfitted hunters in the Mackenzie Mountains, 1979-1990.

Woodland Caribou

The total number of woodland caribou harvested by outfitted hunters in the Mackenzie Mountains varied significantly among years (X^2=72.9, P<.05). A decrease in the mid-1980s (Fig. 8) was followed by an increase to the levels of the early 1980s. A mean of 112 (s.e. ±8) woodland caribou (total=1344) have been taken by outfitted hunters each year in the entire Mackenzie Mountains.

The mean length of left and right antler for caribou taken during the twelve years from the Mackenzie Mountains by outfitted hunters was 114.7 cm (s.e. ±.41) and 114.5 cm (s.e. ±.41) (total=1037 caribou). Comparison of left and right antler length (main beam) found no significant difference between the two (t-test, t=-1.37, P>.05), thus only the right antler was used for further analysis.

There was no significant difference among years (ANOVA, F=1.94, P>.05) (Table 6) in length of the right antler of woodland caribou and pairwise comparisons (Duncan multiple range test) did not show any temporal trends (Table 7). There was a significant difference among outfitters, however (ANOVA, F=6.66, P<.05), and pairwise comparisons (Duncan multiple range test) indicated a significant northward trend in horn length with zone E/1-2 being significantly larger than any other area (Table 8).

There was a marginal statistical difference among years in the maximum spread of antlers from 1979 to 1990 (ANOVA, F=1.84, P=.04), with 1988 and 1989 producing antlers with greater maximum spread

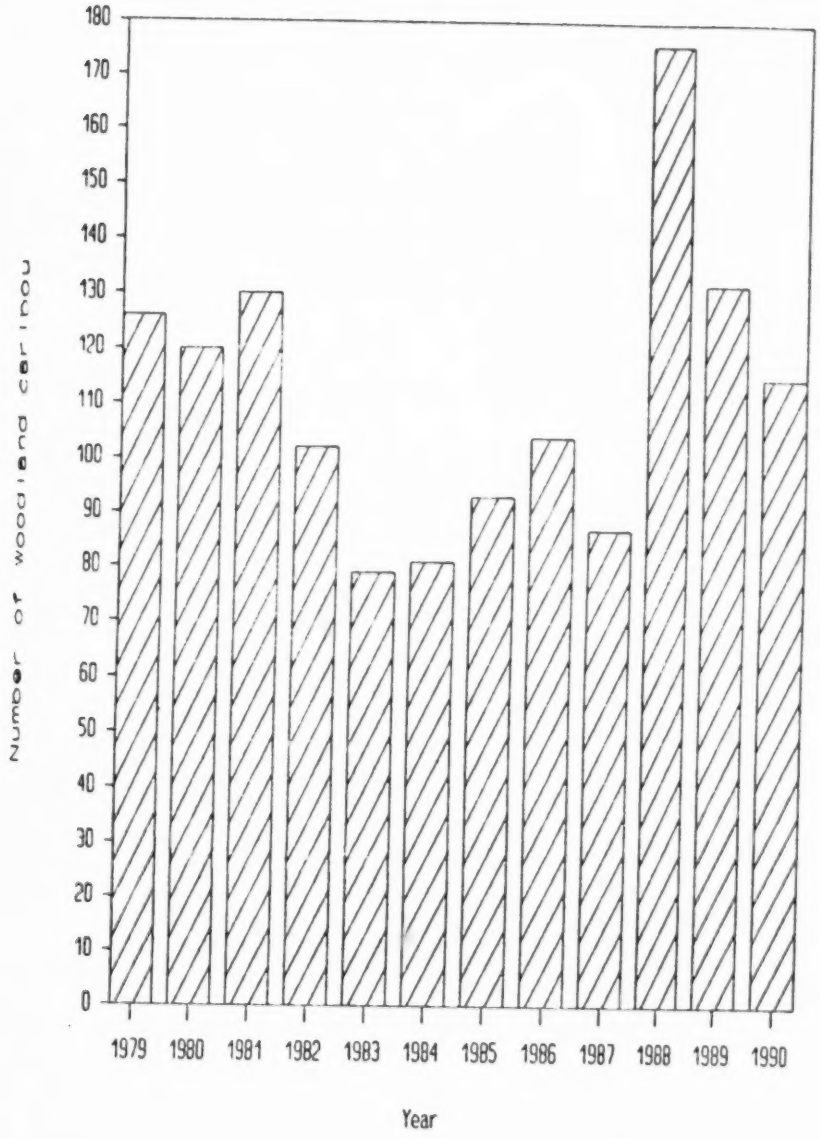


Figure 8. Total number of woodland caribou harvested by outfitted hunters in the Mackenzie Mountains, 1979-1990.

Table 7. Pairwise comparisons by year of mean right antler beam length from woodland caribou. (NS indicates a statistically non-significant difference between two years).

	79	80	81	82	83	84	85	86	87	88	89	90
79	--	NS	**	**	**	**	**	NS	**	**	**	**
80		--	**	**	**	**	**	NS	**	**	**	**
81			--	**	**	**	**	**	**	**	**	**
82				--	**	**	**	**	**	**	**	**
83					--	NS	NS	**	NS	**	NS	NS
84						--	NS	**	NS	**	NS	NS
85							--	**	NS	**	NS	NS
86								--	**	**	**	**
87									--	**	**	NS
88										--	**	**
89											--	NS
90												--

Table 8. Mean beam length of right antler of woodland caribou harvested from each outfitting area, 1979-1990. (Lengths arranged highest to lowest).

Outfitting area	N	Beam length (cm)
E/1-2	91	121.2
E/1-3	127	117.2
E/1-1	26	116.3
E/1-5	320	114.5
E/1-7	37	113.5
E/1-4	229	112.6
E/1-6	202	112.2
E/1-8	5	101.3

Table 9. Mean antler spread (maximum distance between tines) of woodland caribou for each year, 1979-1990. (Spread arranged from highest to lowest).

Year	N	Antler spread (cm)
1988	123	94.1
1989	111	92.4
1984	75	90.6
1987	73	90.4
1981	79	90.4
1986	84	89.9
1983	71	89.8
1980	78	89.6
1985	92	89.4
1990	90	88.7
1982	70	87.1
1979	77	86.5

than the other years (Table 9). There was also a difference among outfitters (ANOVA, $F=7.13$, $P<.05$), although only zone E/1-3 was significantly higher than the other zones (Table 10). Stepwise multiple regression of both left and right antler length against maximum spread found that both left and right antler lengths explained little of the variation in antler spread ($r^2=.16$ for both left and right antlers). In other words, racks with long beams did not necessarily have wide spreads.

Moose

The total number of moose harvested by outfitted hunters in the Mackenzie Mountains varied significantly over the twelve years ($X^2=45.8$, $P<.05$) (Fig. 9) with a marked decline in the mid-1980s followed by a recovery to numbers similar to the early 1980s. A mean of 24 (s.e. ± 2) moose (total=292 moose) were harvested by outfitted hunters each year in the entire Mackenzie Mountains and the mean antler spread for moose over the twelve year period was 139.8 cm (s.e. ± 1.0)(n=236).

There was no significant difference among years in maximum antler spread (ANOVA, $F=1.72$, $P>.05$) (Table 11), although there was a slight trend toward larger trophies during the last five years. Similarly, there was no significant difference between outfitting zones in maximum antler spread (ANOVA, $F=0.89$, $P>.05$), although the harvest by each outfitter has varied greatly during the twelve years (Table 12).

Table 10. Mean antler spread (maximum distance between any two tines) of woodland caribou harvested from each outfitting zone, 1979-1990.

Outfitting area	N	Antler spread (cm)
E/1-3	125	97.4
E/1-8	5	94.5
E/1-2	81	92.1
E/1-4	229	91.4
E/1-1	24	89.1
E/1-7	37	88.5
E/1-6	204	88.1
E/1-5	318	87.5

Table 11. Mean antler spread (maximum distance between points) of moose for each year, 1979-1990. (Spread arranged from highest to lowest).

Year	N	Antler spread (cm)
1986	22	144.5
1985	19	144.1
1988	35	144.0
1990	25	143.6
1979	23	140.4
1989	24	138.4
1987	22	138.0
1981	16	137.0
1984	14	135.4
1982	14	134.8
1983	9	132.5
1980	13	129.3

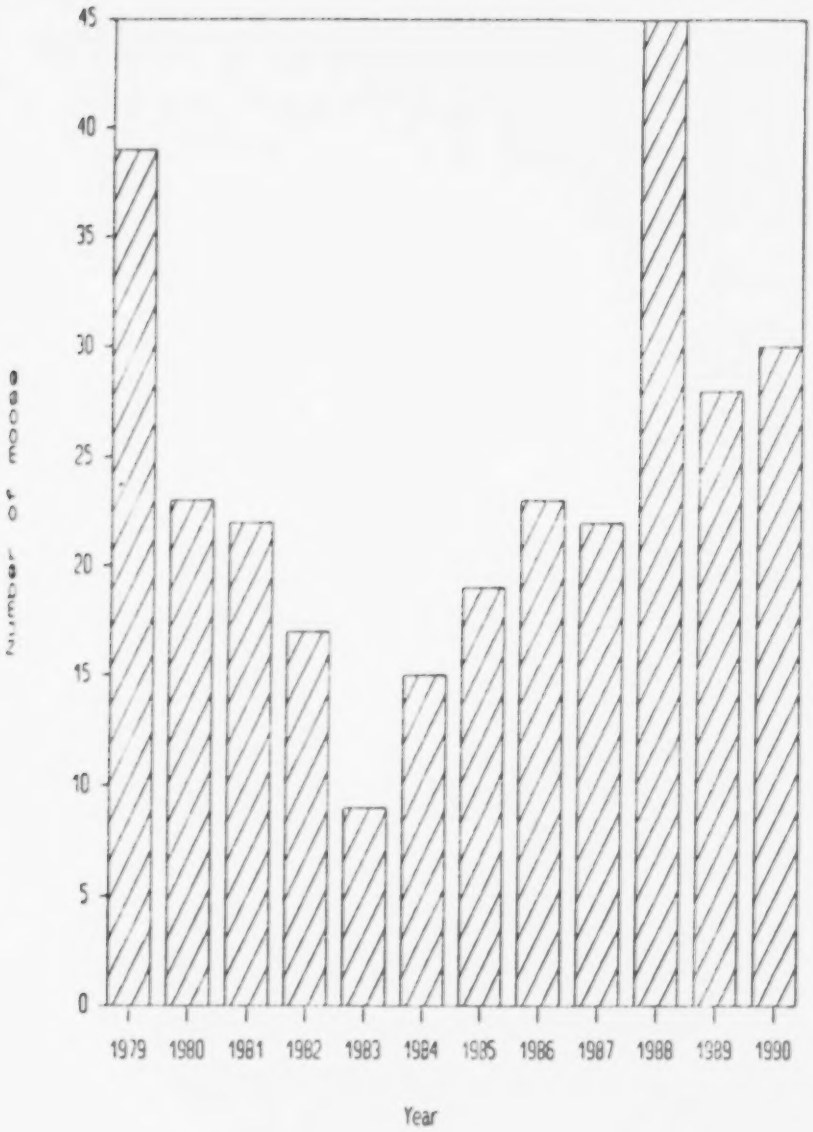


Figure 9. Total number of moose harvested by outfitted hunters in the Mackenzie Mountains, 1979-1990.

Table 12. Mean antler spread (maximum distance between points) of moose harvested from each outfitting area, 1979-1990.

Outfitting area	N	Antler spread (cm)
E/1-4	53	143.1
E/1-2	45	141.2
E/1-8	9	139.9
E/1-6	10	139.3
E/1-3	43	139.2
E/1-5	71	137.2
E/1-1	4	136.5
E/1-7	1	120.0

Mountain Goat

A total of 17 mountain goats were harvested by outfitted hunters in the Mackenzie Mountains during the last twelve years. All goats came from zones E/1-4 (n=10) and E/1-7 (n=7). Mean length of the longer horn was 20.3 cm (s.e. $\pm$.5) (total=17).

Wolf and Wolverine

A total of 91 wolves were harvested by outfitted hunters in the Mackenzie Mountains during the last twelve years (Table 13). Two centrally located outfitting zones (E/1-5, 1-6) have accounted for just over half (51%) of the wolves taken. There was no significant difference among outfitting area in the length of raw

wolf pelt (ANOVA, F=1.38, P>.05). The mean raw pelt length for all wolves taken during this period was 182.2 cm (s.e. ±2.6)(total=91).

A total of 9 wolverines were harvested by outfitted hunters in the Mackenzie Mountains during the last twelve years (Table 13).

Table 13. Number of wolves and wolverines harvested from each outfitting zone, 1979-1990.

	E/1-1	E/1-2	E/1-3	E/1-4	E/1-5	E/1-6	E/1-7
Wolves	7	11	10	11	20	28	4
Wolverine	2	1	1	2	2	1	-

Hunter Effort

The number of days each hunter spent in pursuit of the various big game species was reported for 1979-1985 and 1988-1990. These data were pooled for subsequent analysis.

The mean number of days hunted before a Dall's sheep was taken was 5.3, for woodland caribou 3.5, and for moose 3.8. Pairwise comparison of the three species (Duncan multiple range test) indicated that hunters spent significantly more time hunting Dall's sheep than either woodland caribou or moose. There was no statistically significant difference among years for sheep (ANOVA, F=1.02, P>.05), but for woodland caribou and moose there was (ANOVA, F=3.09 and 1.14, P<.05), indicating more inter-year variability for these two species.

The eight outfitting zones differed significantly in the number of days in which Dall's sheep and woodland caribou were hunted (ANOVA, $F=11.6$ and 3.62, $P<.05$), but not for moose. Hunters spent more days hunting Dall's sheep in the northern zones than in the southern zones. There was no geographic trend in the number of days spent hunting woodland caribou.

Dall's sheep remain the most sought after big game species in the Mackenzie Mountains. Plotting the kill locations of sheep within each zone, indicated that outfitters were harvesting sheep from a relatively broad area within their respective zones. Caribou and moose showed a more clumped distribution of kill locations. These data remain confidential, however, and are on file at the Department of Renewable Resources, Norman Wells.

DISCUSSION

Considering the number of recorders involved between 1979 and 1990, there exists the possibility of bias in these data. However, the standardized nature of the measurements for all species, the generally high experience level of all persons involved, and the completeness of returns over the twelve years probably minimized this bias.

Apart from the significant decline in numbers of outfitted hunters and, consequently, big game taken during the early to mid-1980s, the outfitting industry in the Mackenzie Mountains from 1979 to 1990 was stable in numbers of big game taken. From about 1985 to 1990, big game taken rebounded to the levels of the early 1980s. Reasons for the decline in number of hunters were not clear but may have been related to the economic recession of the early 1980s. The large majority of hunters (78%) continued to be from outside Canada.

Trophy quality appears to have remained stable from 1979 to 1990, at least as reflected by basic antler and horn dimensions. No temporal trends were detected during this period in terms of decreasing or increasing size of trophy for either Dall's sheep or woodland caribou. There was a suggestion, however, that moose trophies increased slightly in size (antler spread) during the last five years. A significant northward trend in increasing trophy size for both Dall's sheep and woodland caribou was detected. However, this result must be considered with caution because of the

sensitivity of the statisitical testing to the large sample sizes. The actual separation between the northern and southern outfitting zones amounted to only 2-3 cm on the length of horn for Dall's sheep and 6 cm on the beam length of caribou; this was probably not a biologically significant difference. Although trophy size of Dall's sheep did not change over the twelve years, hunters did harvest older sheep during the latter part of that time. Reasons for this discrepancy are unclear. One possibility is that latterly, outfitters were hunting more on poorer sheep range where rams have less horn growth compared to rams on better range. Consequently, hunters who are generally seeking the maximum trophy size, may have been harvesting older sheep on these poorer ranges.

Each hunter devoted more time to hunting Dall's sheep than to either woodland caribou or moose. The time each hunter devoted to hunting Dall's sheep remained the same from 1979 to 1990. Although hunters spent less time hunting woodland caribou and moose than Dall's sheep, there was greater year to year variability for woodland caribou and moose. Hunters in the northern zones appeared to spend more time hunting Dall's sheep, undeniably the most desireable trophy species sought in the Mackenzie Mountains, than hunters in the southern zones. Why hunters in the northern zones would be spending more time hunting Dall's sheep and obtaining slightly larger trophies than the more southern zones is not clear. There could be a complex interaction of factors involved such as style of hunting (e.g., greater emphasis on backpack rather than horseback hunting by the more northern outfitters), terrain (i.e.,

ease of travel), or biological such as the relative growth rates and productivity of the sheep in the north versus the south.

Without even fundamental knowledge of population sizes and productivity of the major big game species in the Mackenzie Mountains, especially woodland caribou and moose, it is difficult to assess the impact of current levels of big game hunting. Most Dall's sheep rams in the Mackenzie Mountains, as in other areas (Barichello et al. 1987), probably attain full-curl at 7 yrs. The large majority of Dall's sheep (approx. 85%) taken by hunters in the Mackenzie Mountains are, therefore, full-curl individuals (see Results - age distribution). If this represents a light-moderate harvest of the full-curl rams then, as found elsewhere (Barichello et al. 1987; Heimer in prep., pers. comm.), the current harvest is probably sustainable. Extrapolations from an aerial survey conducted in 1988 (Latour 1992) speculated that only about 20% of available full-curl rams in zone E/1-1 were being harvested each year. Recent investigations by the Department of Renewable Resources of Dall's sheep numbers and productivity on the study areas of Simmons (1982,1984) in the central Mackenzie Mountains indicated a situation virtually unchanged over the intervening fifteen years (Shank et al. in prep.).

Outfitters appeared to hunt Dall's sheep and woodland caribou over large portions of their zones. Given that each zone contains a certain amount of poor sheep range it is likely that almost all mountain blocks containing good populations of sheep, and especially rams, have been hunted at least periodically over the

last twelve years. There are probably very few, if any, completely unhunted Dall's sheep ranges remaining in the Mackenzie Mountains, although some outfitters still speak of unhunted areas within their zones and their desire to direct more hunting pressure there. The woodland caribou harvest appeared to be somewhat more localized than the sheep harvest. A considerable amount of the caribou harvest occurred relatively close to the major base camps within each outfitting zone, especially in those zones having the largest caribou harvest. This same pattern also applied to moose.

ACKNOWLEDGEMENTS

Cooperation by the outfitters operating in the Mackenzie Mountains has, by and large, been very good over the years. The Department of Renewable Resources wishes to thank them for this. Thanks also go to the Wildlife Officers from Norman Wells, Fort Simpson, and Fort Liard who have demonstrated diligence in assembling and organizing the data returned from the field.

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